

## Robotic Air Monitoring System

**T**he Environmental Services Project and the Human, Robotic and Remote Systems Department of the Idaho National Laboratory have teamed up to develop the Robotic Air Monitoring System. This system uses state-of-the-art technology to characterize contaminated airborne plumes — such as those caused by wildfires and other unexpected events.

### Overview

The project team is developing a real-time automated guidance system on an aerial platform to collect air samples within airborne plumes to collect them most accurate data it possibly can. The team is also researching methods to improve the stability of small unmanned aerial platforms that perform these functions to improve their consistency and overall performance under various conditions. Instrumentation is also being added to ensure that when sample are taken, an on board global positioning system (GPS) will record the location, and time of the sampling event. Other features the team is developing include: low-power, lightweight, and portable air sampling devices; and, designing all aspects of the aircraft to limit its impact on the air being sampled. As part of this research activity, the following elements are also being developed:

- Mobile sensor interface design
- Ground- and aerial-based mobility platforms to test sensors, robots, and human interfaces
- Sensor development, modification and optimization for field-ready



*INL's unmanned aerial vehicle (UAV) expertise is recognized for its autonomous control architecture, and its use in aircraft like this helicopter that has a range of up to two miles, a flight time of one hour and a total sampling time of 1/2 hour.*

deployment and improved mobile platform navigation

- Video and photographic capabilities.

### New Technology

The small robotic air sampling systems are unique in that they enable a user to collect samples in hazardous environments that previously were impossible to collect. In addition, these smaller systems are less expensive to purchase, own and operate. And, the difficulties associated with always piloting

small remote controlled aircraft within a line of sight are being resolved. With the technology developed for this program, it is now possible to fly the systems beyond line of sight and into hazardous areas.

### Innovations

The system not only uses GPS, it also has advanced attitude sensing, and a microcomputer to automatically fly the craft to a sample collection point and then return to the launch area.

*Continued on back*

Science



*Continued from front*

Another key technology is the ability to actually collect an air sample using a new light weight, low-power, and portable air sampler. The equipment collects the sample and records the total volume of air in the sample. Once the craft lands, the sample filter can be removed and analyzed. In addition to grab sampling, real-time sensors and video surveillance equipment may be installed to enhance its ability to gather other useful data.

#### **Accomplishments**

We have successfully deployed a small unmanned aerial fixed wing platform containing a small GPS navigation package. During the deployment, a small UAV was air lifted to a starting altitude and position,

and the autonomous control system was activated and autonomously flew the pre-programmed course — maintaining the desired altitude and relaying real-time video and GPS coordinates. This seven ounce navigation package, including the GPS unit and servo controller, cost less than \$500. This work is currently being applied to small roto-craft vehicles that are basically small-size helicopters. These small helicopters can carry three times the payload of fixed wing aircraft. These small helicopters have been deployed to take required photographs for a Wastewater Land Application Permit, and pictures for an interactive mapping project involving a Vadose Zone Research Park.

***The monitoring system is also being designed to share information with other autonomous unmanned ground vehicles that perform environmental monitoring.***

#### **For more information**

##### **Management Contact**

**Jerry Harbour**  
Acting Manager,  
Human Robotic & Remote  
Systems Department  
208-526-4301  
[Jerry.Harbour@inl.gov](mailto:Jerry.Harbour@inl.gov)

##### **Technical Contacts**

**Mark McKay**  
208-526-0539  
[Mark.McKay@inl.gov](mailto:Mark.McKay@inl.gov)

**Matt Anderson**  
208-526-4308  
[Matthew.Anderson@inl.gov](mailto:Matthew.Anderson@inl.gov)

INL is a U.S. Department of  
Energy national laboratory  
operated by Battelle Energy  
Alliance

